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| 10/714,180   | 11/14/2003  | Peter C. Rieke         | 50005-162           | 9390             |
| 32215 7590 06/23/2009<br>KLARQUIST SPARKMAN, LLP<br>121 SW SALMON STREET, SUITE 1600<br>ONE WORLD TRADE CENTER<br>PORTLAND, OR 97204 |             |                        |                     |                  |
| EXAMINER<br>LEWIS, BEN   |             |                        |                     |                  |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

## Application No.

10/714,180

## Applicant(s)

RIEKE ET AL.

## Examiner

Ben Lewis

## Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 09 March 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-10, 13-29, 32-38, 96-101, 103-120, 122-128 and 130-132 is/are pending in the application.
- 4a) Of the above claim(s) 96-101, 103-108 and 111 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10, 13-29, 32-38, 96-101, 111-120, 122-128 and 130-132 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**Detailed Action**

1. The Applicant's amendment filed on March 9<sup>th</sup>, 2009 was received. Claims 1, 20-23, 115 and 128 were amended.
2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action (issued on December 9<sup>th</sup>, 2008).

***Claim Rejections - 35 USC § 112***

3. Claim 17, 36 and 126 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The recitation of "said cathode layer comprises a substantially homogenous mixture of a copper-substituted ferrite material and a finely-divided form of a second material" in claims 17 and 36 is not present in the specification as originally filed.

***Claim Rejections - 35 USC § 103***

4. Claims 1-10, 15-19 and 112, 113, 115 rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997).)

With respect to claims 1,3, 4, 115, Aizawa et al. (US 6,692,855) teaches a solid oxide fuel cell for electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum oxide material. The modified lanthanum oxide material is in direct contact with said zirconium-containing material; and wherein said fuel cell has a power density of at least about 1.0 W/cm<sup>2</sup> at 750°C and 0.7V. The reference does not teach a cathode comprising a modified lanthanum ferrite perovskite.

Kindermann et al. teaches a cathode material for a solid oxide fuel cell that produces electricity by electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned is inherently in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum ferrite perovskite material; wherein said modified

lanthanum ferrite perovskite material is in direct contact with said zirconium-containing material; and wherein said fuel cell includes a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Kindermann et al. in a fuel cell having the structure taught in Aizawa in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1.) The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

With respect to claim the fuel cell being operable at temperature less than about 750 °C, Aizawa et al as modified by Kindermann do not disclose fuel cell operating temperature data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al as modified by Kindermann and the present application utilize the same copper substituted ferrite perovskite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing

feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 2 and 7, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant

With respect to claims 5 and 6, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant

With respect to claims 8, 112-113, Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

With respect to claims 9-10, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula:  $\text{La}_{1-x}\text{A}_x\text{B}_y\text{Fe}_{1-y}\text{O}_3$ . See Page 11, Lines 20-22. Aizawa et al. as modified by Kindermann et al. do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Kindermann et al. and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 15 and 16, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

5. Claims 13-14, 32-33, 122 and 123 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)) in view of Badding et al. (U.S. Pub. No. 2001/0044041 A1).

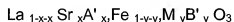
With respect to claims 13-14, 18, 32-33, 122 and 123, Aizawa et al. as modified by Kindermann et al. disclose a solid oxide fuel cell above. Aizawa et al. as modified by Kindermann et al. do not specifically teach wherein the copper substituted ferrite material comprises a layer having a thickness from about 1 to 50 microns or having a thickness from about 1 to 30 microns. However, Badding et al. disclose high performance solid oxide electrolyte fuel cells (title) wherein With more conventional perovskite-type electrode materials such as  $\text{La}_{0.85}\text{Sr}_{0.15}\text{MnO}_3$ , or other manganites, electrode resistivity is typically about 10 sup.-2 ohm-cm, or essentially 3 orders of magnitude higher than the resistivities of precious metal-containing electrodes. In these



cases the electrode designs generally involve smaller electrodes with shorter current path lengths (as low as 2 mm), higher electrode thicknesses, (>20 microns), and/or highly conductive current collectors in contact with the electrodes. Electrodes less than around 20 microns in thickness, however, are generally preferred for minimizing material usage and enhancing the flexibility and thermal shock resistance of the electrode/electrolyte structure (Paragraph 0056). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the electrode thickness of Badding et al. for the cathode thickness of Aizawa et al. as modified by Kindermann et al. because Badding et al. teach that Electrodes less than around 20 microns in thickness, however, are generally preferred for minimizing material usage and enhancing the flexibility and thermal shock resistance of the electrode/electrolyte structure (Paragraph 0056).

6. Claims 1, 20-29, 32-38, 112-120, 124-125, 127-128 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energietechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154 and further in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)

With respect to claims 1,3, 4, and 20, 23, 24, 25, 27, 37, 114, 115, 117, 118, 119, 127, 128, the teachings of Aizawa et al. (US 6,692,855) and Kindermann et al. have been presented. The reference does not teach a cathode comprising a modified lanthanum ferrite perovskite as claimed. Forthmann et al., however, teaches a cathode material for a solid oxide fuel cell that produces electricity by electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned is inherently in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum ferrite perovskite material; wherein said modified lanthanum ferrite perovskite material is in direct contact with said zirconium-containing material; and wherein said fuel cell includes a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. The fuel cell cathode contact layer comprised a perovskite (LASK)  $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$  (see the Abstract). Forthmann et al. teach that the (LASK)  $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$  were sintered onto the interconnectors of the fuel cell stack (See abstract). Forthmann et al. teach interconnects with gas passages (See Fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was

made to use the cathode material taught in Forthmann et al. in a fuel cell having the structure taught in Aizawa as modified by Kindermann et al. in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1 .) The amount of copper in the material is considered to be about 0.01 to about 0.05 because 0.2 is about 0.05." Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to alter the amount of copper in the material in order to achieve the desired properties of the stabilized material. Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation, *In re Aller, Lacey and Hall*, 105 U.S.P.Q. 233,235. The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

With respect to claim the fuel cell being operable at temperature less than about 750 °C, Aizawa et al. as modified by Forthmann et al. and Kindermann et al. do not disclose fuel cell operating temperature data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Forthmann et al. and Kindermann et al. and the present application utilize the same copper substituted ferrite perovskite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. *In re Robertson*, 49 USPQ2d 1949 (1999).

With respect to claim 19, Forthmann et al. teach that the (LASK)  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$  were sintered onto the interconnectors of the fuel cell stack (See abstract).

With respect to claims, 28-29, Aizawa et al. as modified by Forthmann et al.. teach a fuel cell including a cathode layer of a perovskite composition having the formula:  $\text{La}_{1-x}\text{Sr}_x\text{A}'_x\text{Fe}_{1-y-y'}\text{M}_y\text{B}'_y\text{O}_3$



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula:  $\text{La}_{1-x}\text{A}_x\text{B}_y\text{Fe}_{1-y}\text{O}_3$ . See Page 11, Lines 20-22. Aizawa et al. as modified by Forthmann et al.. do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Forthmann et al.. and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed

invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 19 and 38, Frothmann et al. teach interconnects with gas passages (See Fig. 2).

With respect to claim 21, 116, Frothmann et al. teach that the fuel cell cathode contact layer comprised a perovskite (LASK)  $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$  (See Abstract). Therefore the copper is present at 4 atomic percent. Examiner notes that copper is a B-site atom in the LASK formula of Frothmann et al.

With respect to claims 22 and 26, Frothmann et al. teach that the fuel cell cathode contact layer comprised a perovskite (LASK)  $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$  (See Abstract). Therefore the copper is present at 4 atomic percent. 4 atomic percent reads on "about 5 atomic percent." Examiner notes that copper is a B-site atom in the LASK formula of Frothmann et al.

With respect to claims 34-35, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper substituted ferrite material

of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 112-113, Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

With respect to claims 120, Forthmann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte. The fuel cell cathode contact layer comprised a perovskite (LASK)  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$  (See Abstract).

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula:  $\text{La}_{1-x}\text{A}_x\text{B}_y\text{Fe}_{1-y}\text{O}_3$ . See Page 11, Lines 20-22. Forthmann et al do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Forthmann et al and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 124 and 125, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

7. Claims 130-132 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energietechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154 and further in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)

With respect to claim 130-132, Aizawa et al. as modified by Forthmann et al. and Kindermann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte. The fuel cell cathode contact layer comprised a perovskite (LASK)  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$  (See Abstract). Forthmann et al. also disclose perovskite  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Ni}_{0.2}\text{O}_3$  (LSFN) (See page 150). Examiner notes the B site atom is Ni in (LSFN). Examiner also notes that Forthmann et al. also disclose perovskite LSM where the B site atom is Mn. Examiner also notes that

Frothmann et al. disclose LSFC where the B site atom is Co (See page 150). The Frothmann reference does not teach wherein the electrolyte layer comprises a yttria-stabilized zirconium oxide, however Applicant teaches that Solid oxide fuel cells (SOFCs) employing a dense ceramic electrolyte are currently considered as one of the most attractive technologies for electric power generation. In a typical SOFC, a solid electrolyte separates the porous metal-based anode from a porous metal or ceramic cathode. Due to its mechanical, electrical, chemical and thermal characteristics, yttria-stabilized zirconium oxide (YSZ) is currently the electrolyte material most commonly employed. (Page 2 Applicant's Specification). Examiner notes that due to Applicants own admission of the use of yttria-stabilized zirconium oxide (YSZ) as an electrolyte material being well known in the fuel cell art it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the use of (YSZ) as an electrolyte material in the fuel cell of Frothmann et al.

### **Response to Arguments**

8. Applicant's arguments filed on March 9<sup>th</sup>, 2009 have been fully considered but they are not persuasive.

*Applicant's principal arguments are*

(a) Aizawa discloses  $(Ln_{1-x} Sr_x)_{1-\delta} MnO_3$  or  $(Ln_{1-x} Ca_x)_{1-\delta} MnO_3$  as potential SOFC cathode materials. However, Aizawa does not teach or suggest using any transition metal other than Mn. Further, Aizawa discloses the presence of iron only as a minor



dopant in amounts ranging from 0.01 wt% to 0.5 wt%. (Col. 6, 11.62-65.) The Examiner alleges that Aizawa discloses "copper as a dopant in a lanthanum perovskite material." However, the copper containing material disclosed in Aizawa *et al.* is for use as a tight ceramic film forming an interconnect. (Col. 17, 11.8-15, and col. 18, 11.40-49) The material is not used as a cathode. Additionally, the material is a lanthanum chromite, not a lanthanum ferrite material as presently claimed. Kindermann discloses SOFC cathodes comprising transition metal-substituted lanthanum ferrite perovskites, where the transition metal is selected from Cr, Mn, Ni, or Co. (Page 909, col. 2.) There is no teaching or suggestion in Kindermann to select any transition metal other than the four listed metals. Further, Kindermann provides no discussion of the respective merits of the transition metals listed. Simply because copper is also a transition metal does not mean that a person of ordinary skill in the art at the time of the invention would have predicted any gainful benefit attributable to copper compared to other transition metals in the context of lanthanum ferrite perovskite.

(b) The material of claims 8, 112, and 113 comprises two B-site dopants: Cu and another dopant selected from the group listed. Aizawa also does not teach or suggest a copper- substituted lanthanum ferrite material having two B-site dopants.

(c) With respect to claims 9 and 10, the Examiner again provides the formula discussed above in relation to claims 2 and 5-7, and states that one of ordinary skill in the art would have been motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. It is assumed the Examiner means the *lanthanum* ferrite

perovskite material of Kindermann. Kindermann, however, does not disclose the referenced formula. Nor does Kindermann teach or suggest using Cu as M. As set forth above in relation to claim 1, there is no suggestion or motivation provided by Kindermann or Aizawa to select copper in place of the transition metals listed by Kindermann. Additionally, as previously discussed, Aizawa teaches copper as a dopant in an interconnect material comprising lanthanum chromite, but does not teach or suggest copper as a dopant in a lanthanum ferrite material for use as a SOFC cathode. Thus, although the polarization resistance values of claims 9 and 10 may indeed be inherent to the claimed material, the combination of Aizawa and Kindermann fails to teach the copper-substituted ferrite perovskite material of claim 1.

(d) As previously discussed, the combination of Aizawa and Kindermann does not teach a copper-substituted ferrite perovskite. Also, neither reference teaches a SOFC that is operable at temperatures less than about 750 °C. Forthmann discloses contact coatings that are placed between cathodes and interconnectors of fuel cell stacks comprising individual SOFCs connected to each other through electrically conductive interconnectors. (Forthmann, page 149.) Forthmann discloses several compositions, including  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$  ("LSFK"). However, Forthmann indicates that the substituted lanthanum ferrite perovskites are less suitable than the other disclosed compositions: "There is a pronounced chemical interaction of the substituted  $\text{LaFeO}_3$  perovskites with the interconnector steel under formation of poorly conductive spinels (such as, for example,  $\text{FeCr}_2\text{O}_4$ ) that increase the transitional resistance to the

interconnector." (Forthmann, page 150.) In contrast, effective coatings "show no or only a negligible chemical interaction with the cathode and the interconnector." (Forthmann, page 149.) Thus, Forthmann actually teaches away from using the LSFK formulation. Also, Forthmann does not teach or suggest using the substituted lanthanum ferrite perovskite compositions as cathode materials. Forthmann only discloses their use as a contact coating between the cathode and the interconnector. Finally, Forthmann does not teach or suggest a SOFC that is operable at temperatures of less than about 750 °C. Forthmann discloses only that the coatings were sintered at 900 °C, and contact resistances were measured at 800 °C. (Forthmann, pp. 152-153.)

In response to Applicant's arguments, please consider the following comments.

(a) and (c) The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

(b) Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

(d) Forthmann et al. teach that the (LASK)  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$  were sintered onto the interconnectors of the fuel cell stack (See abstract). Forthmann et al. teach interconnects with gas passages (See Fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Forthmann et al. in a fuel cell having the structure taught in Aizawa as modified by Kindermann et al. in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1 .) The amount of copper in the material is considered to be about 0.01 to about 0.05 because 0.2 is about 0.05." Examiner also notes that even though Forthmann teach LASK as a contact coating between the cathode and the interconnector examiner notes that this contact coating is part of the cathode and is made of LASK which is a material that facilitates cathode electrode reactions in a solid oxide fuel cell.

### ***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ben Lewis/

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Examiner, Art Unit 1795

/PATRICK RYAN/

Supervisory Patent Examiner, Art Unit 1795